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MANGROVE ECOSYSTEMS

A MANUAL FOR THE ASSESSMENT OF BIODIVERSITY

A follow up of the
National Agricultural Technology Project
(NATP.), ICAR.

Mangrove Ecosystem Biodiversity :
Its Influence on the Natural Recruitment of
Selected Commercially Important Finfish and Shellfish
Species in Fisheries

Edited by :
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Mangrove Vegetation

P. K. Jayasurya, P. Kaladharan, M. S. Rajagopalan, S. Dam Roy and A. K. Sadhu

Introduction

Mangrove vegetation includes plants ranging from herbs, shrubs to tall trees. In favourable conditions the mangrove trees can form dense forests in intertidal habitats. However; only a few species form a massive canopy.

The main characteristic features of these special type of plants are the **tidal amplitude**, defined by the species, and their ability to tolerate high salinity and stress. The majority of the plant groups have adaptations like **prop and stilt roots** for fixing support and the **pneumatophores** otherwise called the **breathing roots** for exchanging gases and the **viviparous** germination. In addition to these, the plants have leathery, dark, ever green leaves with deeply embeded stomata and aquous tissues.

The ecosystem is rich in organic production through the decay of the various plant litter and also by the influx of nutrients from the sea and land, which provide **an ideal nursery ground for many acquatic organisms.** The plants with aerial roots and the pneumatophore belts **give shelter for the juveniles** of Fishes, Crustaceans and Shellfish. The main type of root system of these plants also trap the rich nutrient ladden soil and provide a favourable ground for the growth of many species besides preventing soil erosion.

The major species of mangrove flora and their associates, with identification keys and also the main characteristic features are given below:-

FAMILY : RHIZOPHORACEAE

Leaves coriaceous; corolla convolute or inflexed in bud; stamens 8 or many; anthers one celled, ovary inferior.

GENUS

1(a) Moderate trees with extensive stilt roots or looping bow-roots;flowers tetramerous..... **4. *Rhizophora* L.**

1(b) Small to moderate trees, without extensive aerial stilt like or bow like roots; flowers pentamerous or with more floral segments ..... **(2)**

2a (1) Moderate tree without any aerial root like pneumatophores or stilt roots; stamen numerous ..... **3. *Kandelia* W & A**

3b (1) Small to moderate trees or shrubs; aerial roots knee like, rounded or knobby apex on the aerial roots; stamens twice as many as the calyx lobes, petals with marginal hairs ..... **(3)**

3a (2) Moderate trees; leaves usually more than 12 cm long, apex usually acute; calyx 8-16 lobed; hypocotyle with persistant thin calyx teeth, scarcely ridged ..... ***1.Bruguiera*** **Lamk**

3b (2) Shrubs or small trees, leaves usually less than 10 cm; rounded apex; calyx 5-6 lobed; hypocotyle ridged, persistant calyx dried and less prominent ..... ***2. Ceriops*** **Arn.**

1. *Bruguiera* Lamk.

SPECIES

1a. Flowers usually larger, 3-4 cm long, reddish; petals upto 16 mm long ..... **(2)**

1b. Flower usually small, 1-2 cm long or smaller, not reddish; petals 1.5 to 4 mm long ….....…..... **(3)**

2. Leaves elliptic oblong; petal lobe tip acute with three filamentous appendages .....…… **2 *B. gymnorrhiza* Lamk.**

3a (1) Calyx lobes slender, short upto 3mm; spreading in fruits; petals 1.5 to 2.0 mm long ..…..... ***3. B. parviflora* W. & A.**

3b (1) Calyx lobes stout, long upto 5mm, refexed in fruits; petals 3-4 mm long.....…….

B. cylindrica

1.1 *Bruguiera cylindrica* (Lamk)

A true mangrove species. Tall tree, upto 25 m height, bark smooth, grey with few lenticels, leaves oblanceolate, rarely elliptical acute or bluntly pointed apex, 15 cm long and 5 cm broad. Flowers 0.8-1.2 cm long, greenish: calyx tube very small smooth, 8-10 lobes: petals 0.3-04 cm long. Fruits up to 1.5 cm long.

Bruguiera cylindrica
(Source - Dam Roy S., 2003)

1.2 *Bruguiera gymnorrhiza* (L.) (Fig. 1)

Maximum height, 15-20m; tall tree, much dense branched spreading, branches and stems marked with leaf and stipule scars. Short or shallow buttress like aerial roots, thickened trunks base, leaves elliptic oblong, acute apex, or bluntly pointed, coriaceous 7.5-15.0 cm long and 5.0 to 7.5 cm broad, dark green. Flowers solitary axillary, calyx deep orange red/yellow ribbed, campanulate large flowered 3-4 cm. Calyx tip acute, 11-13 numbers. Petals 1.2-1.6 cm long, tip acute with three appendages (Hypocotyl cigar shaped)

Fig. 1. ***Bruguiera gymnorrhiza***

1.3 *Bruguiera parviflora* Wight & Arnold

Medium tree upto 16 m height; branches not spreading, much smooth grey bark. Shallow butteresed from the trunk base, root-knees occasionally blunt end, pneumatophores present, leaves simple, 7.5-10.0cm long and 2.0-4.0 cm broad, oblong lanceolate or elliptic lanceolate, brightly shining above, dull beneath, glabrous. 2-5 flowered erect cymes, 2 cm long; calyx tube ridged. Petals 1.5 mm long, flower yellow-greeny fruit, obconical.

2. *Ceriops* Arnold

2.1 *Ceriops tagal* (Fig. 2)

Ever green small or moderate tall tree, canopy conical. Aerial roots form shallow buttressed and root knees or flange like plank roots in the base of the trunks. Leaves simple 8-10 cm long and 4-5 cm broad, obovate-oblong, apex rounded, glabrous. Flower small (5-7mm) in axillary cyme, sepals 5 lobed, petals 5, white, shorter than calyx. Fruits slightly conical 1.5 to 2.0 cm long, pointed apically. (Hypocotyl ridged)

Fig. 2. ***Ceriops tagal***

3. *Kandelia* Wight and Arnold

3.1 *Kandelia candel* (L.) (Fig. 3, Plate I)

Small to medium tree, upto 7 m height; bark smooth greenish or reddish brown; without any aerial roots, but occasionally aerial roots develop in some cases, leaves opposite, oblong-elliptic apex obtuse, 6.5-10 cm long and 2.5-4 cm broad, dark green and polished above. Flowers white 1.5-2.0 cm long in axillary cymes, 4-9 flowered, calyx lobes linear acute,

petals bifid. Fruits 1.5-2.5 cm long. (Hypocotyl slender and pointed)

Fig. 3. ***Kandelia candel***

4. *Rhizophora* L.

SPECIES:

1a Leaves dark green, tips acute; inflorescence 2 flowered cymes; Petals glabrous; stamens 12; stigma almost sessile; fruits and seedling maturing well below twig . **4.1. *R. apiculata***

1b Leaves dark green, tips pointed, mucronate; inflorescence more than 2 flowered, cymes; petals hairy; stamens 8; stigma sessile; hypocotyle warted ... **4.2. *R. mucronata* Lamk.**

4.1 *Rhizophora apiculata*

Medium tree, upto 20 m height, coexist with other members of *Rhizophoraceae*; branches much spreading horizontally and erect with prominent fallen leaf scar marks, looping stilt roots upto 3-5 m height, occasionally bending like bow or pendulous/hanging roots, 5-10 cm diameter of these aerial stilt roots. Leaves dark green glabrous, oblong lanceolate, acute, petiolate. Flowers in pairs, white stigma almost sessile. Fruit 2.5-3.0 cm long, seedling radicle length upto 50 cm, radicle surface smooth, collar present.

4.2. *Rhizophora mucronata* Lamk (Fig. 4, Plate II)

Medium tree, upto 20 m height, coexist with *Ceriops spp*; and *Bruguiera spp*; branches spreading horizontally and erect marked with fallen leaves-scars. Stilt roots looping from the lower trunks and horizontal branches, form very gregarious dense growth of corky, fleshy, cylindrical 5-6 m long, 5-6 cm diameter Sometimes hanging from the trunk or bow roots, leaves dark glossy green, thick and cuticularised, 15 cm long & 8 cm broad, apex pointed, mucronatae. Flowers white, large in few flowered axillary cymes, 2-3 chotomously branched; stigma sessile. Fruit coriaceous 2.5-3.5 cm long. Cotyledonary collar absent in the radicle with warted surface and more pointed.

Fig. 4. *Rhizophora mucronata* in the middle flanked by *Rhizophora apiculata*

FAMILY: AVICENNIACEAE

Avicennia L.

SPECIES:

1. Leaves never glacious, whitish underneath, coriaceous, elliptic oblong or ovate-oblong, obtuse, glabrous, smooth & shining above ..... ***A.officinalis* L.**

1. *Avicennia officinalis* L. (Fig. 5)

True mangrove species, medium tree upto 20m height with smooth bark. Branches both spreading and erect. Pencil like pneumatophores; occasionally stilt roots present; all these aerial roots with thick corky aerenchyma cells and numerous lenticels present on the cortex, leaves coriaceous, elliptic, oblong or obovate oblong, very obtuse or rounded apically, glabrous, smooth and shinning above, never glaceous whitish beneath, 10-14 cm long and 4-6 cm broad. Flowers zygomorphic; sessile in compact heads, 6-8 mm in diameter corolla orange/ yellow, glabrous within tetramerous, capsule contain 4 seeds - seeds flattened with in testa.

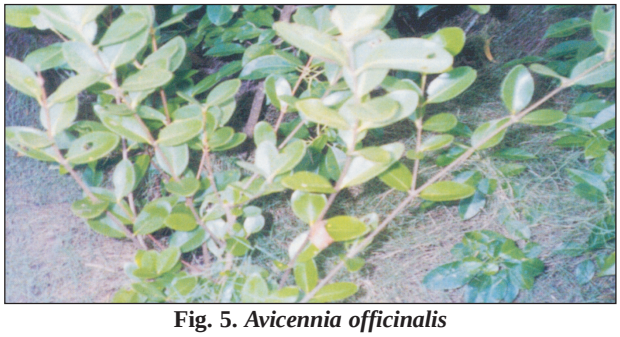

Fig. 5. ***Avicennia officinalis***

FAMILY: SONNERATIACEAE

SPECIES:

Plants moderate to tall trees, (6-8 m) in the inner estuary, twigs, diffused branched, slender occasionally slightly pendulous, leaves glabrous opposite, elliptic oblong or oval obovate with short petiole, mid vein often red at base, in conspicuous without prominent

vines, petals slender reddish alternate with calyx, best seen in flower bud ... ***Sonneratia caseolaris* (L.) Engler.**

Fig. 6. ***S.caseolaris***

FAMILY: PLUMBAGINACEAE

Cosmopolitan in distribution consisting of herbs or low-shrubs, common in mangrove habitat. Family characters are abundant scleroids, secondary thickening, viviparous seed germination.

Genus : ***Aegialitis***

Salt water loving plants, swollen trunk base, fluted axis, conspicuous annual leaf scars. Flower pentamerous, bisexual, regular with bract and bracteoles white.

Aegialitis rotundifolia. Roxb. Fl.

Shrub without any aerial roots, trunk base broad due to basal fixed upright roots, stem swollen, spongy, bark dark grey, tap root sunken, stem straight, leaf simple, alternate, exstipulate, petiolate, lamina broadly ovate, slightly fleshy, dark green dorsal side shiny, entire, inflorescence-raceme, branched, peduncle long, flower bracteate, lanceolate, entire, complete, bisexual, pentamerous regular, calyx-sepals 5, gamosepalous, 5 lobes above, short adjoining at base, entire, green, valvate, inferior, corolla-petals 5, white, imbricate, entire, alternate to sepals, Androceium-Stamens-5, adhere to filament, extrose, basifixed, inferior Gynoceium-carpels-5, syncarpus, ovary oblong, one chambered, basal placentation, style 5, stigma absent.

FAMILY: MYRSINACEAE

A large family with more than thousand species and characterized by free - central placentation.

Fig. 7. *Aegiceras corniculatum*

GENERA:

1. Fruit cylindric; seeds exalbuminous ..... ***Aegiceras***

1.1 ***Aegiceras corniculatum* (L.)** (Fig. 7, Plate III)

Small tree or shrub, 2-6 m height, branches horizontally spreading, dense canopy; bark smooth dark grey. No aerial roots, leaves altering or spirally arranged, stipule absent, glabrous both sides, pale green above and glabrous below 5-7 cm long, 2.5-3.5 cm broad elliptic, apex rounded. Flowers fragrant, perfect white 1-2 cm diameter Sepals 5 free, petals 5 pointed end, corolla twisted. Fruit 5-8 cm.

FAMILY: EUPHORBIACEAE

Plant with milky sap; ovary superior, 3 locular ovules collaterals, pendulous with ventral raphe.

GENERA:

1. Flowers in terminal spikes, regimes or panicle…….... **2**
2. Calyx deeply 3-partite; flowers in lateral axillary or terminal, spiciform, unisexual (dioecious or monoecious) or androgynous racemes or spikes .....……. **1.** ***Excoecaria.* L.**

1. ***Excoecaria*. L**

SPECIES

1. Halophyta tree ……...…… ***E.agallocha* L.**

***Excoecaria agallocha* L.** (Plate IV)

Medium tree upto 15 m height, partially deciduous, with poisonous milky latex, bark-grey. Without any aerial roots, but when tidal water current washed away the bottom soil then horizontal underground roots are exposed, look like snake-cable roots. Leaves spirally arranged, coriaceous or fleshy, simple, terete, petiole 1-2 cm long. Unisexual flowers in axillary inflorescence. Fruit 3 lobed, Schizocarp 1.5-2.0 cm diameter Seed length 0.3 cm.

FAMILY: ACANTHACEAE

Family includes tropical herbs, shrubs or even small trees with zygomorphic, sympetalous usually conspicuous flowers irregular with 2 to 5 stamens. Prominent bracts and bractioles present; ovary bilocular, fruits 2 or more seeded capsule surrounded by hardened funicle.

***Acanthus* L.**

Plant (Fig. 8, Plate V) usually have spiny margined leaves, (yellow-green leaves) terminal inflorescence, flower with 2 bractioles and uniform anthers.

Fig. 8. ***Acanthus ilicifolius***

Open flower 3.5-4 cm long; corolla partly light blue or violet. Bractioles persistant, in fruit upto 1 cm long. Ripe fruit 2.5-3 cm long; seed approximately 10 mm in diameter. Inflorescence usually longer than 10 cm. Plants with spiny to very spiny leaves …….....……. ***A.ilicifolius* L.**

***Acanthus ilicifolius* L.**

Acanthus ilicifolius otherwise called a SEA HOLLY, a low sprawling or some what viny herb, scarcely woody, grows to a length of 2 m. Axes initially erect but reclining with age, branching commonly from older parts. Aerial roots from lower surface of reclining stems. Leaves decussate, usually with a pair of spines, glabrous, petiole short, blade gradually tapered below. Inflorescence terminal, forming bracteate spike. Each flower with bract, often caducous, lateral bracteoles 2, conspicuous and persistant. Calyx 4 lobed, the upper lobe conspicuous and enclosing the flower bud, lower lobe some what smaller, lateral calyx lobes narrow, wholly enclosed by upper and lower sepal. Corolla zygomorphic with a short tube closed by basal hairs; abaxial tip broadly 3 lobbed to entire, adaxial lobe absent. Stamens 4, sub equal, with thick hairy connectives. 2 celled anther, aggregated around the style. Ovary bilocular, 2 ovules in each locule, style enclosed by stamens, the capitate to pointed styma exposed, fruit capsule.

FAMILY: **TAMARICACEAE**

Family consists of 120 species under 4 genera and characterized by shrubs or herbs with alternate simple inter-exstipulate leaves. Flowers solitary or in raceme.

Genus: ***Tamarix*.L.**

The genus has about 90 species and most species are distributed in the coastal areas and *Tamarix gallica.L*. is the common species.

***Tamarix gallica*.L**. (Fig. 9)

Leaves simple, exstipulate, opposite decussate cat kin inflorescence, branched, flower pink violet, bisexual, regular, sepals 5 gamosepalous, valvate, petals 5, apical, acicular lobe, valvate, stamens 5, free, filament white, basifixed, Carpels 3, syncarpus, ovary superior, basal placentation, one chambered fruit capsule.

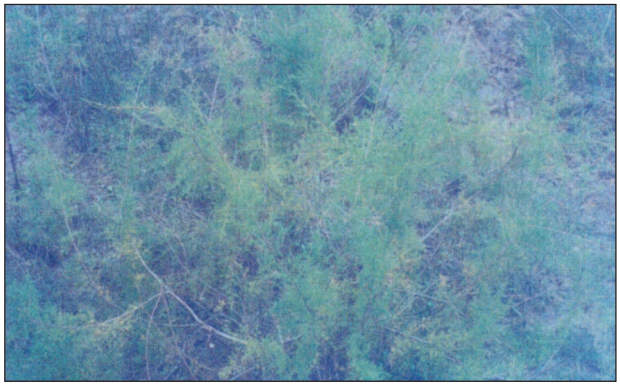

Fig. 9. ***Tamarix gallica***

FAMILY: FABACEAE

Glandular and non-glandular hairs, epidemic of leaf may be papillose, stomata paracytic type.

Genus: ***Caesalpinia***

SPECIES

1. Shoot apex is covered by gregarious spines, flowers unisexual by abortion ….....**1. *C. bonduc* (L.)**

1. Caesalpinia bonduc (L.) Roxb

Climbing much branched shrub, gregarious spines present, nodes not rigid, internode having gregarious spines, woody, mature branches brown, having dense pubescent. Leaves compound, alternate, stipulate, paripinnate, axis glabrous, terete, lamine having short petiole, green, pulvinous, entire, reticulate venation. Raceme lateral or axillary, flower unisexual, irregular, male flower sepals-5, polysepalous, entire, blunt, petals 5, polypetalous imbricate, alternate to sepals. Stamens 10, free, dorsifixed anther extrinose Female flower: by abortion, carpels-2,bisexual, flowers, syncarpous, superior ovary, two ovules parietal placentation, style 1, stigma 1.

FAMILY: ASCLEPIDACEAE

Asclepidaceae is closely related to other families like Oleaceae, Gentianaceae and Loganaceae but distinguished from others by the presence of gymnostegium.

***1. Sarciolobus globosus* Wall.**

Prostrate and climbing herb or shrub. Poorly branched presence of milky latex. Tap root – deep sunken. Nodes slightly ridged, but not jointed; in climbing condition branches become weak but in prostrate condition branches become thick, leaves simple, opposite decussate, exstipulate, petiolate, whitish green, mid-grooved, pulvinous, dorsiventral green, branched cyme, thick flower, whitish green, complete bisexual, regular, pedicillate, flower pentamerous, sepals-5, polysepalous, interior, imbricate, entire, alternate to petal. Petals-5 – gamopetalous, interior, ovate, pink-white, twisted, stamens –5 gynostegium attached to the stigma, corolla absent, filament short, anther bilobed, carpels-2 syncarpous, superior style 1 – terminal, stigma 2 – bipartite.

2. Sarcolobus carinatus

Climbing herb, nodes slightly rigid but not jointed, green grey leaves, simple, opposite decussate, existipulate, petiolate, yellowish green, terete, entire, acute, cup shaped or angled, distinct mid vein, reticulate venation, corymbose, peduncle unbranched, bract short, flower complete, bisexual, regular pedicellate, pentamous hypogynous. Sepals-5, polysepalous, inferior, imbricate, petals-5, gamopetalous, inferior, entire, scattered brown dot like spots on the outer surface of petals, stamens 5 – gynostegium attached to the stigma, filament short, carpels 2, syncarpous, superior ovary, axile placentation, style-1 terminal, stigma 2, globose.

FAMILY: BORAGINACEAE

Family consists of 7 genera and 2000 species.

Genus : *Heliotropicum.* L.

These species grow in the salt crusted soil and very often grow in highly saline soil.

***Heliotropicum curassavicum.* L.**

Prostrate, much branched spreading herb, leaves simple, exstipulate, opposite decussate, lanceolate, inflorescence helicoid cyme, flower bisexual, regular, complete, sessile, sepal 5, polysepalous, inferior petals-5 gamopetalous, cylindrical tube below stamens-5 epipetalous, filament very short, anther bilobed, carpels 2, syncarpous, ovary superior, 4 chambered, one ovule in each chamber, axile placentation, style 1, stigma absent.

Family : Chenopodiaceae

Chenopodiaceae characterized by having fleshy habitat. This family has about 120 genera and 1,400 species distributed throughout the world.

GENUS : *Suaeda.* Forsk.

Cosmopolitan distribution, characterized by halophytic herbs with fleshy leaves and dense cymes.

SPECIES

1a. leaves broad, green, style-2, seeds usually horizontal ……..**1. *S. maritima*.**

1b. leaves semi-terate, green but reddish after maturation

Styles –3, seeds erect ….....…… ……..…… **2. *S.nudiflora***

1. *Suaeda maritima*. Dumort

Leaves simple, alternate, exstipulate, sessile, succulent, green. Spike at leaf axis, small flower. Flower bisexual, complete, regular, sessile, hypogynous, tepals-5, polypetalous, imbricate, acute, succulant. Stamens 5, free basifixed, anther bilobed, carpels 3, Syncarpous, ovary superior, single chambered with single ovule, basal placentation. Fruit drupe.

***3. Suaeda nudiflora* Roxb** (Fig. 10)

Prostrate herb having erect branches, internode not rigid, leaves simple, alternate, exstipulate, green, but after maturity it becomes red. Spike at least axis, flowers: bisexual, complete, regular, tepals-5, polytepalous, imbricate, fleshy, green stamens 5, free, white, anther bilobed, carpels 3, syncarpus, ovary superior, single chambered, single ovule, basal placentation. Stigma-0.

Fig. 10. *Suaeda nudiflora*

FAMILY: ARECACEAE

The family is characterized by berry or drupe and

in case of drupe the endosperms usually united to one seed.

1a. Unbranched, caudex palm, single spathe, capsule 3 united, fruit small upto 1.5 cm long. ……. **2 *Phoenix* L.**

1b. Unbranched, rhizomatious palm several spathe, carpels 3, aggregate. Fruit medium upto 12 cm long. ..... **1 *Nypa* Steck.**

1. Nypa fruticans (Thumb) Wurmb (Fig. 11)

Dichotomously branched, rhizomatous stem, underground, fibrous roots, no aerial roots, leaf base spongy, looks like sunken coconut plant. Leaves pinnately compounded spirally arranged on the top, rachis stout, glabrous, shiny, green, isobilateral, distinct mid-vein, parallel venation.

Inflorescence, spadix on a long peduncle, cylinder shaped, spathe enclosed flowers, peduncle erect, male flowers gregariously on each peduncle, tapels-6 polytepalous in 2 whorls, entire, acute, stamens 3,united to form central column, anther bilobed, female flowers tepals 6, carpels 3, free, angular, but funnel shaped. Single ovule, basal placentation, style and stigma, fruits drupe, seeds grooved adaxially, ebracteate, peduncle bent and pendulous. Flowers: ebracteate, regular, unisexual, small. Sepals 4-5, gamosepalous, lobes ovate, entire acute petals absent. Male flower: Stamens 5 fused anther bifurcated, yellow entrose. Female flower bifurcated, yellow introse. Female flower carpels 4-5, ovary superior, single chambered, with one ovule, basal placentation. Fruit capsule.

Fig. 11. ***Nypa fruticans***

***2. Phoenix paludosa*. Roxb. Hort.**

Unbranched perennial palm, fibrous roots, aerial pneumatothods are also developed, stem slender, cylindrical, unbranched, covered with dark fibrous sheath, distinct leaf scar, woody, leaves pinnately compound and rachis spirally arranged on the top of the stem, stem base mostly covered with spines of fibrous leaf sheath, rachis long, sheathing at base, leaflets bi-forms, apex spinous, distinct mid-vein, unicostate, parallel venation. Spadix spongy, yellow, glabrous; covered with the inflorescence at young state, flowers sessile, sepals-3, gamosepalous, valvate, petals 3, polypetalous, entire, thick, yellow, stamens 6, free, sessile, anther bilobed, yellow, extrose, female flower sessile, not showing gamosepalous, cup-shaped petals 3, imbricate, carpels 3, syncarpus, ovary superior, dumbel shaped, 1-seeded, style nil, stigma 3, short, fruit drupe.

FAMILY: AIZOACEAE

The family is characterized by xerophytic or halophytic herbs or shrubs, leaves often fleshy.

1. *Sesuvium portulacastrum.* L.

Prostrate much branched herbs, tap root system poorly developed, fleshy, spongy, nodes jointed, pink, short, leaves simple, opposite, decussate, petiolate, fleshy, spongy, distinct mid veins, solitary cyme, flower complete bisexual, regular, pedicillate, pink, sepals-5, polysepalous, imbricate, entire, fleshy, corolla absent, stamens numerous, free, basifixed, anther bilobed, carpels 3, syncarpous, ovary 3 chambered, style-3, stigma 0, fruit capsule.

FAMILY : SOLANACEAE

Solanaceae has about 85 genera, including 2,200 species.

***1. Solanum trilobatum.* L.**

Trailing with prickly hooked, shrubs, grow on bushy dry soil, nodes and inter-nodes not rigid, inter-nodes tapering towards end, leaves, simple, exstipulate, petiolate, entire round, inflorescence: corymbose, raceme, flowers: bisexual, regular, complete, violet green, hypogynous, sepals-5, polysepalous, entire, imbricate; petals-5, gamopetalous, bell shaped, ovate, entire, violet, stamens-5, epipetalous, soft, basifixed, anther yellow, carpels-2, syncarpus, fleshy, axile placentation, style-1, stigma absent.

FAMILY**: MELIACEAE**

Genus: *Amoora*

***Amoora* (*Aglaia cucullata*)**

Medium tree, leaves compound, leaf let 2-4 pairs and an old one opposite, oblong, elliptic, sepals short

round, petals-long, staminal tube shorter than petal, ovary stalked.

FAMILY : POACEAE

Genus: *Myriostachya*. Hook

***Myriostachya wigtiana* (Nees ex steud) Hook**

Clums tufted, erect, stout, sheathed, sometimes floating with long branched roots, simple, leaf blade broad, serrated, finely acuminate, inflorescence panicle whorled flowering, spikelets 4-8 flowered, pedicels short.

FAMILY : PTERIDACEAE

A large family of true ferns, their memebrs having sporongia covering the undersurface of pinna.

***Acrostichum* L.**

Rhizomatous fern, (Fig. 12, Plate VI) common in mangroves, axis horizontal or erect pinnate leaves upto 3m long, with a terminl leaflet, rachis rounded and smooth below scales on petiole base not having a prominent scar, plant axis horizontal, branched young leaves red in colour……..… ***A. aureum* L.**

Fig. 12. *Acrostichum aureum*

Suggested References

Cook, T. (1901-1908). *The Flora of Presidency of Bombay* **2** Vols. London.

Dam Roy, S. (2003). *A Compendium on Mangrove Biodiversity of Andman and Nicobar Islands.* CARI, Port Blair, Andmans - 744 101.

Gamble, J.S. and C.E.S. Fisher. (1915-1936). *Flora of the Presidency of Madras* **3** Vols. London**.**

Hooker, J.D. (1872-1897). T*he Flora of British India* **7** Vols. London**.**

Kumudranjan Naskar (1993). *Plant wealth of the lower Ganga Delta* **2** Vols. Delhi.

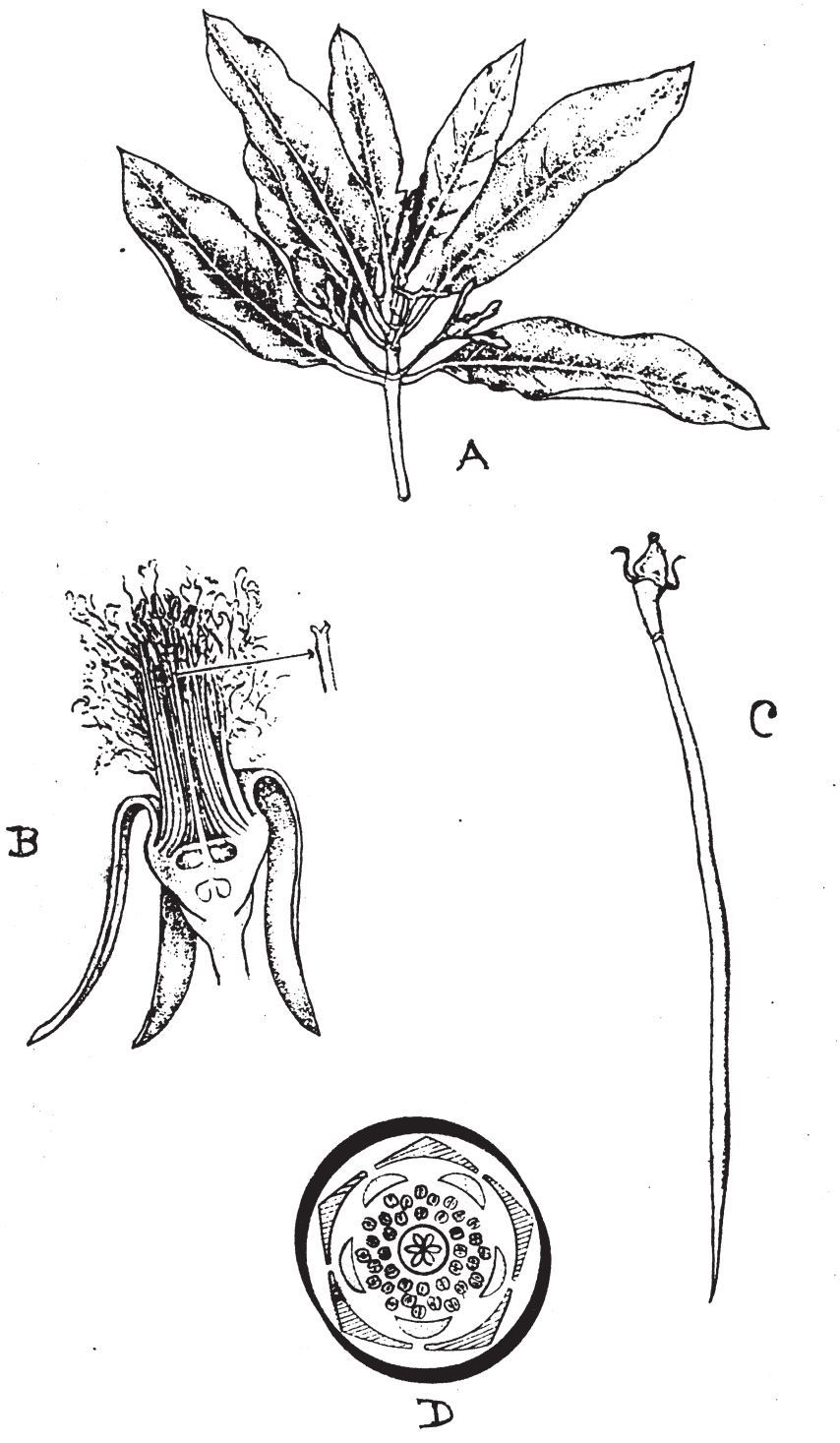

Plate I. ***Kandelia candel***
(A) Shoot with flowers, (B) L. S. of flower, (C) Mature detached seedling, (D) Floral diagram

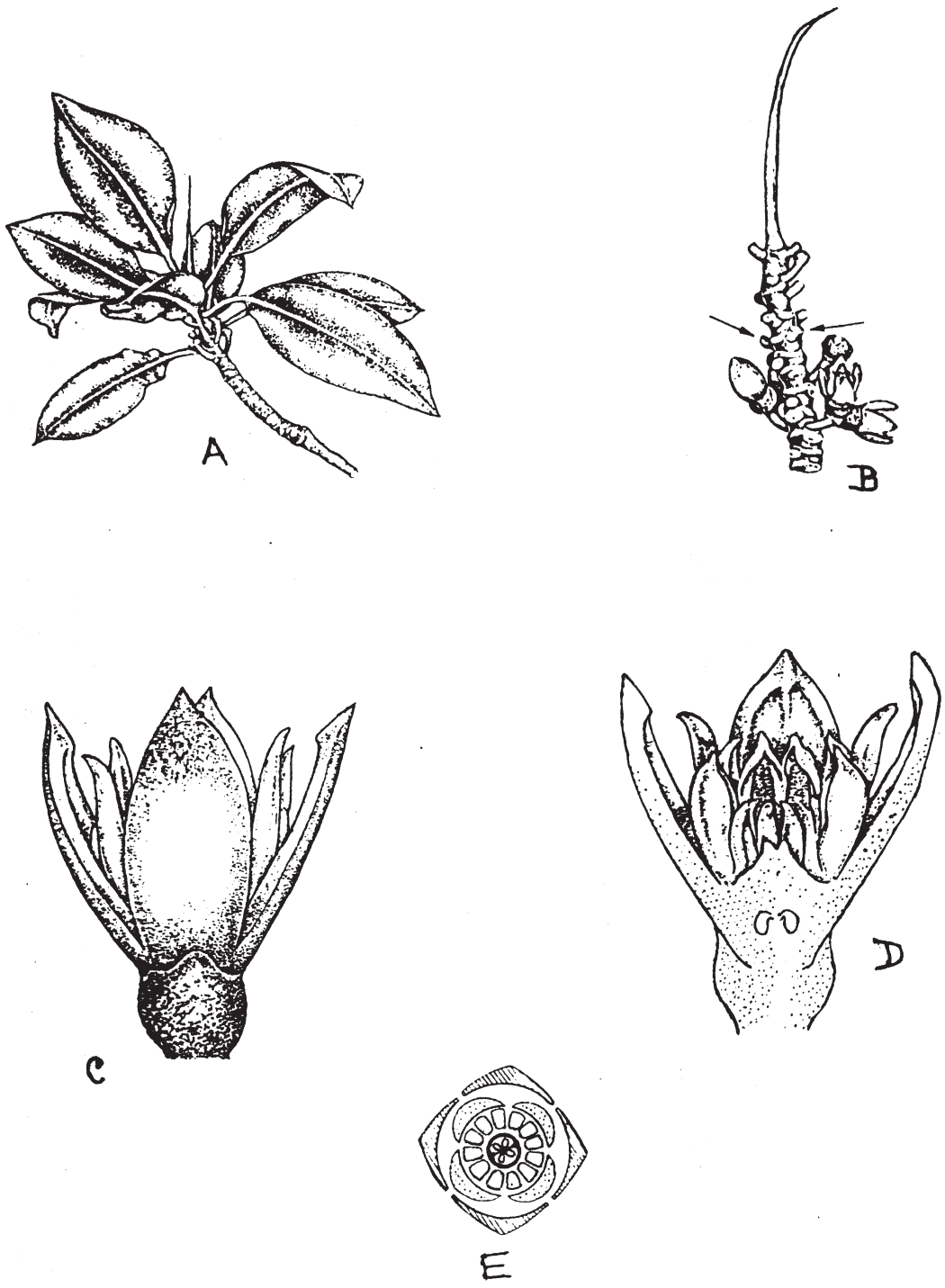

Plate II. ***Rhizophora apiculata***
(A) Shoot with inflorescence, (B) Twig with flower, (C) Entire flower, (D) L. S of flower, (E) Floral diagram

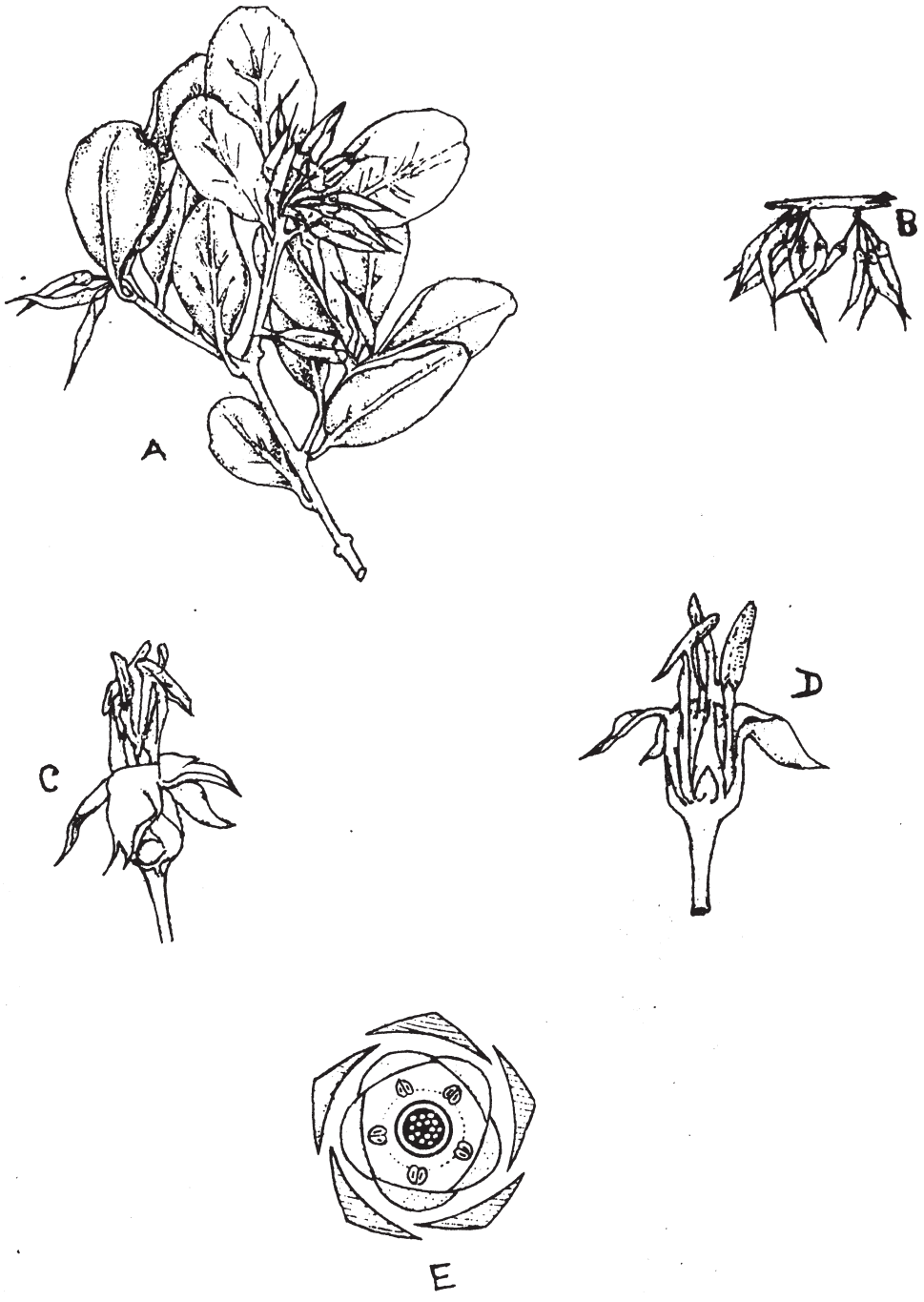

Plate III. ***Aegeiceras corniculatum***
(A) Entire plant, (B) Flowering clusters on shoot, (C) Opened flower, (D) L. S. of flower, (E) Floral diagram

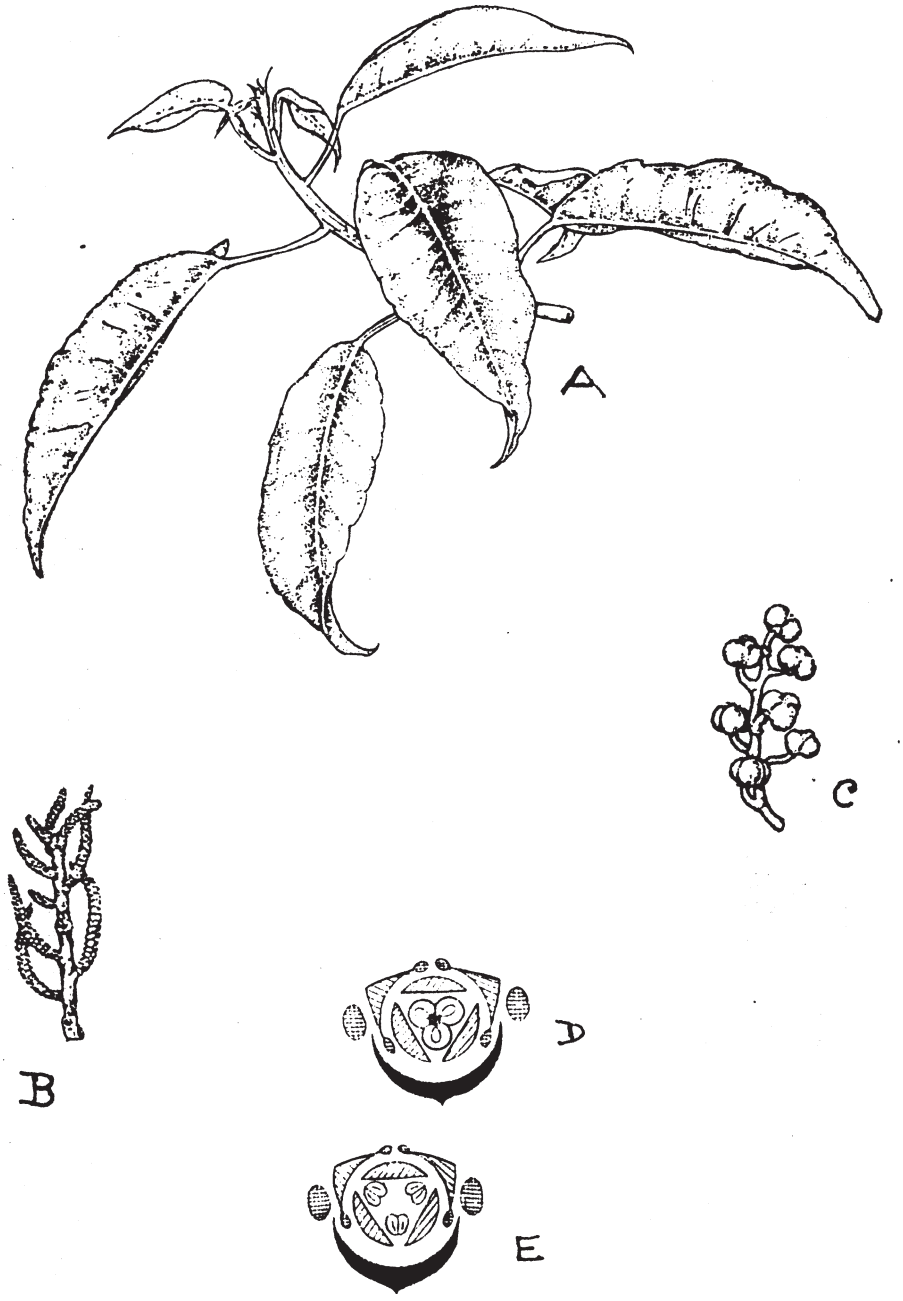

Plate IV. ***Excoecaria agallocha***
(A) Shoot, (B) Immature male spikes, (C) Immature fruits, (D) Floral diagram of male flower, (E) Floral diagram of female flower

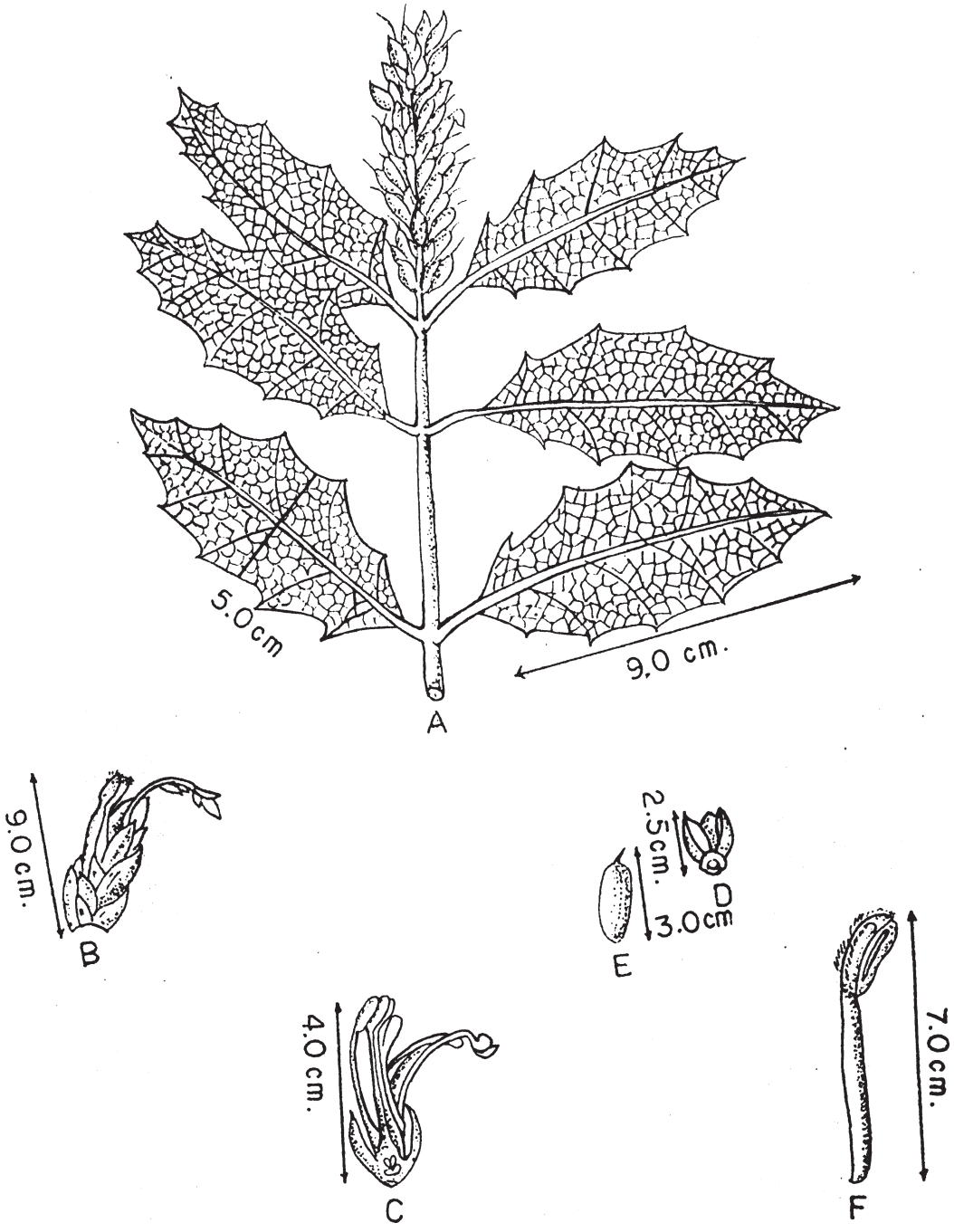

Plate V. ***Acanthus Ilicifolius***
(A) Habit with flower, (B) Part of inflorescence, (C) L.S of flower, (D) Sepals, (E) Fruit, (F) Gynoecium

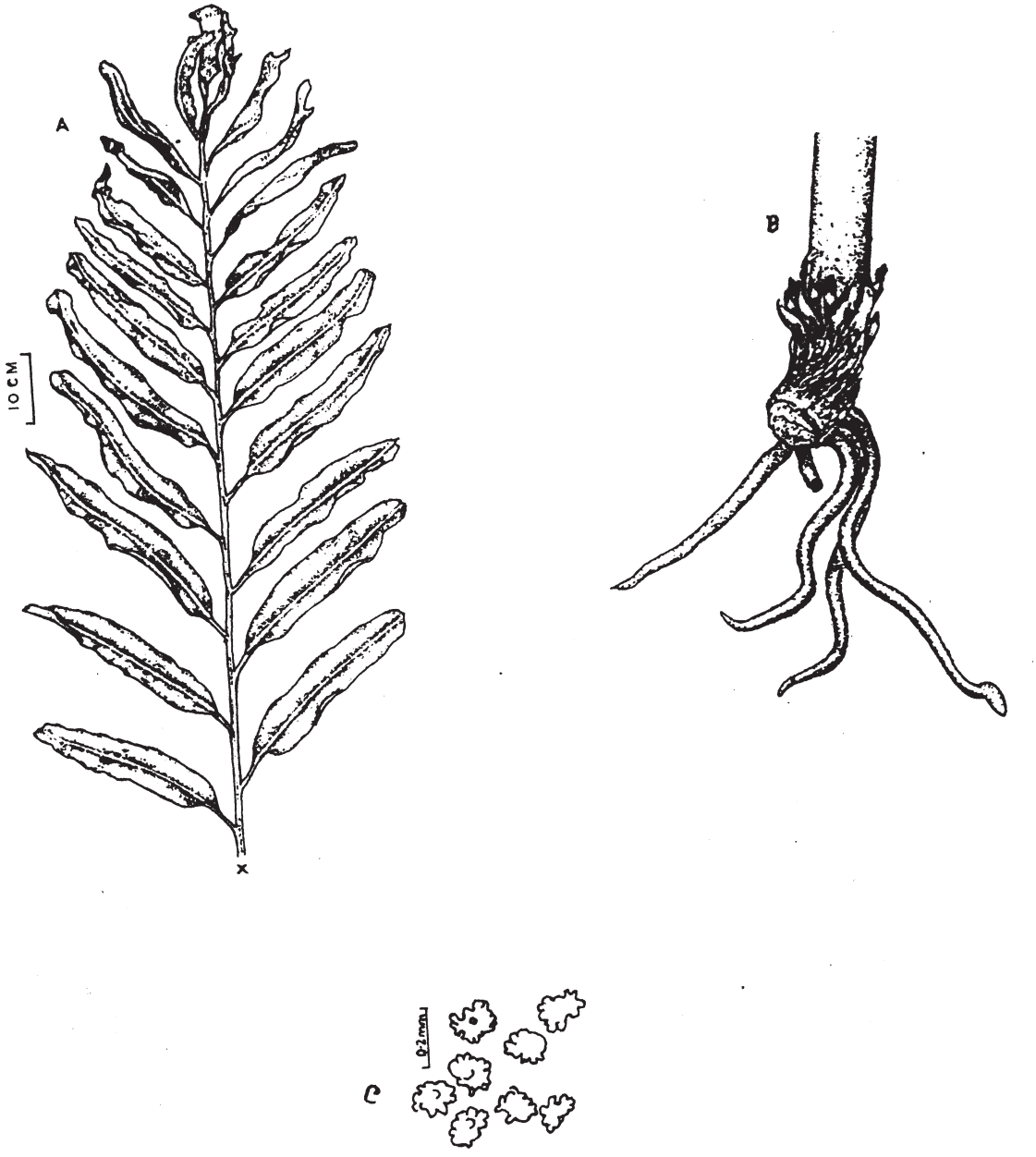

Plate VI. ***Acrostichum aureum***
(A) Upper part of frond, (B) Leaf base with adventitious roots and scale leaves, (C) Paraphyses